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Skates in NAFO Divisions 3LNO and Subdivision 3Ps: A Preliminary Examination

by

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[1]La présente série documente les bases scientifiques des évaluations des ressources halieutiques sur la côte atlantique du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

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ABSTRACT

With the decline in the 'traditional' groundfish resources in the waters around Newfoundland, interest in the exploitation of alternate species has increased. In 1993 the Provincial Department of Fisheries carried out experimental fishing for skates, and the work was continued in 1994 by the Department of Fisheries and Oceans. Markets for skate wings have developed, particularly in Europe, and directed fisheries began during 1994. These have continued into 1995. The first quotas were imposed for 1995, and these were based on limited biological information. Research survey data from 1984 to 1994 have been examined as well as information on maturities and other biological characteristics in order to provide some preliminary information to assist in management of the resource. Survey indices have been declining in divisions 3LN, and to some degree in Subdivision 3Ps as well, while remaining stable in Division 3O. Thorny skates mature at larger sizes in 3O and 3Ps. The data suggest that in may be appropriate to separate the management units to 3LN, 3O and 3Ps.

RÉSUMÉ

Le déclin des ressources de poissons de fond traditionnelles dans les eaux baignant Terre-Neuve a suscité un intérêt accru pour l'exploitation d'autres espèces. En 1993, le ministère des Pêches de la province a lancé une pêche expérimentale de la raie, initiative auquel le ministère des Pêches et des Océans a donné suite en 1994. Des marchés se sont créés pour la raie, en particulier en Europe, et la pêche sélective de ce poisson a commencé en 1994. Elle s'est poursuivie en 1995, année où on a imposé les premiers quotas, fondés sur des données biologiques limitées. On a examiné les résultats des relevés de recherche de 1984 à 1994 et des données sur la maturité et d'autres caractéristiques biologiques pour produire des renseignements préliminaires susceptibles d'aider à gérer la ressource. Les indices émanant des relevés sont en baisse dans les divisions 3LN et, dans une certaine mesure, dans la subdivision 3Ps, mais ils demeurent stables dans la division 3O. La raie épineuse est plus grosse à maturité dans 3O et dans 3Ps. Selon les données, il conviendrait peut-être de séparer en trois unités de gestion les divisions et subdivision 3LN, 3O et 3Ps.

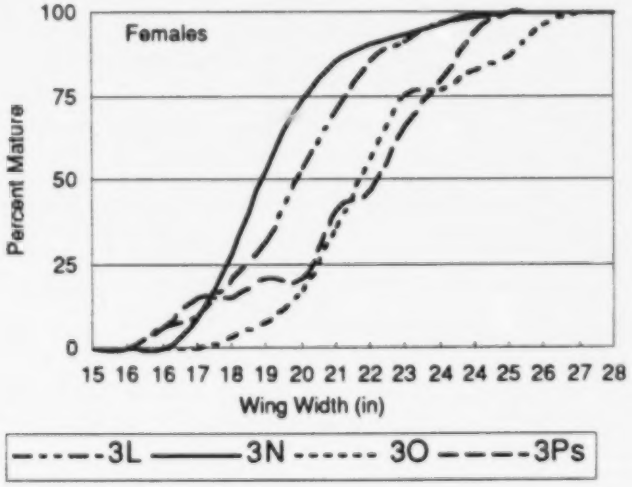
INTRODUCTION

Basic Biology

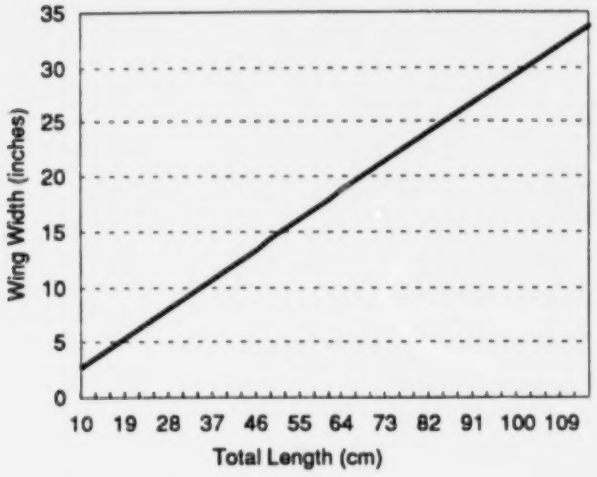
There are some 8 to 10 different species of skate in the waters around Newfoundland. Of these, the thorny skate (*Raja radiata*) is by far the most common, comprising greater than 90% of those caught during research surveys. The second most common is the smooth skate (*Raja senta*). Although data on skate are routinely collected during research surveys, there has been only limited examination of these data. Most of the work to date has been done by Templeman, and dealt with basic biology (Templeman 1982a, 1982b, 1984a, 1984b, 1987). All of this work was on thorny skate, and the information contained in this paper is for that species only. Much of the information provided below is taken from the Templeman papers.

Thorny skate is widely distributed in the waters around Newfoundland. It is found in depths ranging from about 18 to over 1000 m, in temperatures from -1.4°C to about 14°C, and on both hard and soft bottoms. Tagging information suggests that they are sedentary species and generally do not undergo long migrations. Generally they move less than 100 km.

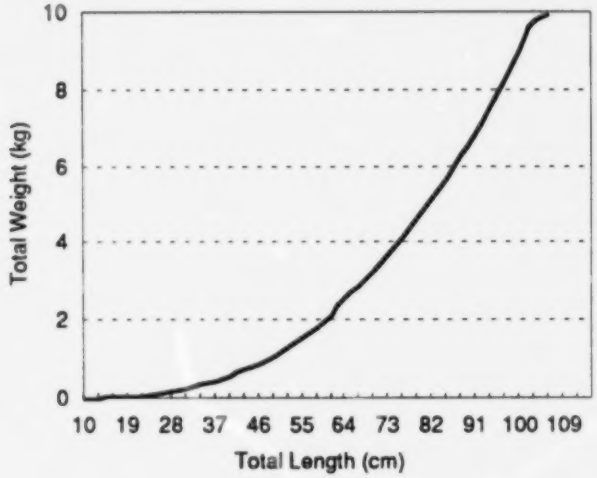
It is not known how long thorny skate live in the waters around Newfoundland. Based on the time between tagging and recapture of some individuals, it is known that they can live at least 20 years. They deposit egg cases, perhaps better known as mermaids' or sailors' purses, inside of which are single embryos. Skates only lay between 6 and 40 of these a year, and their size is related to the size of the parent. It is not known, however, if survival rates vary between sizes of egg cases. Males mature at smaller sizes than females, and size of maturity increases from north to south. Limited data suggest that reproduction occurs year round on the Grand Banks. It can also be seen that female thorny skate in divisions 3LN mature at a smaller size than those further west in Division 3O and Subdivision 3Ps.



Fishermen are interested in the width of the skate wing, as the wing is the product. Based on market conditions, the minimum acceptable size is about 46 cm (18 inches). Combining information from the figure below with that from the maturity figure above indicates that in the 3LN area, about 50% maturity is reached at about 46 cm (18 inches) wing width, but in 3OPs the width at 50% maturity is about (56 cm (22 inches).



The weight - length relationship is about the same for both males and females. A thorny skate with wing width of 46 cm (18 inches) weighs somewhat less than 3 kg.



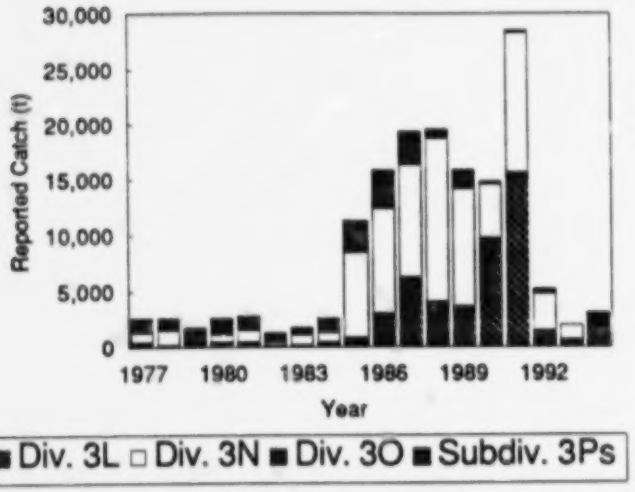
Thorny skate feed on a wide variety of items including both invertebrates and fish. Invertebrate food includes marine worms, crabs and whelks. Fish, which are increasingly important with increasing size, include sculpins, redfish, sand launce and haddock. As well, significant amounts of offal have been found in the stomachs of skate captured in the vicinity of commercial fisheries.

There is very little information on predators of skate around Newfoundland. They have been found in the stomachs of seals, sharks and Atlantic halibut.

The Fishery

Historically, there has been only limited interest in fishing for skate in the waters around Newfoundland. Most of the reported catches have been by non-Canadian fleets; Canadian catches have traditionally been incidental to catches of other groundfish species, and skates were usually discarded. Information on discarding by vessels fishing inside the Canadian zone is available from the Observer Program, but it has not been examined to date.

Catches reported to NAFO from the time of extension of jurisdiction averaged less than 5,000 t until 1985 when the reported catches from Division 3N increased significantly (Table 1).



This increase was due to a great increase in fishing effort outside 200 miles which has continued into the 1990s. The reported catches peaked at almost 30,000 t in 1991. In 1990 and 1991, the high reported catches from Division 3L were associated with the effort directed toward Greenland halibut.

There is some concern about the accuracy of these reported catches. Canadian surveillance has suggested that in some years during the 1980s up to about 60% of the reported skate catches may have actually been misreported catches of other species. Surveillance estimates for 1992 to 1994 are 7,200, 7,350 and 7,900 t respectively. These are higher than the reported catches for those years.

Because of recent declines in the many groundfish fisheries, coupled with the development of markets for previously unutilized species, Canadian interest in fishing for skate has increased significantly in recent years. The Provincial Department of Fisheries conducted an unsuccessful gillnet test fishery in 1993 in Subdivision 3Ps, then pursued an experimental otter trawl fishery in 1994 in 3Ps and 3O. The main concern was to keep by-catches of other groundfish such as cod to a minimum. With the use of a 12" mesh in the codend, the experiment was a success in that good catches of skate were obtained with very little by-catch (Anon. 1994). as a result, by November 1994, over 30 vessels had been issued experimental licences. Most of these vessels were otter trawlers of less than 65 feet, and most of the licences were for Division 3O. Gillnetting, although limited, was also successful. Some experimental longlining was not as successful because of the relatively high by-catches of other species.

During 1994, prices to fishermen were in the 45 to 85 cents per pound range for skin on wings. Indications were that these prices would hold into 1995, and because of the good catch rates experienced during 1994 it was anticipated that the fishery would expand significantly in 1995.

During a meeting of industry and the Department in late 1994, some interests suggested that the fishery for skates in the waters around Newfoundland be unrestricted, similar to the current regime outside 200 miles. Resource Allocation staff however, because of concerns about the sustainability of the resource, adopted a more conservative approach. Although there was only very limited scientific information available at the time, this information was used as the basis for setting catch limits for 1995. Catch quotas were separated between two bank areas; the Grand Banks (divisions 3LNO), and St. Pierre Bank (Subdivision 3Ps). Catch limits were set based on 20% of the average trawlable biomass for research surveys for 1991-1993. This resulted in catch limits of 5,000 t and 1,000 t for 3LNO and 3Ps respectfully for 1995.

MATERIALS AND METHODS

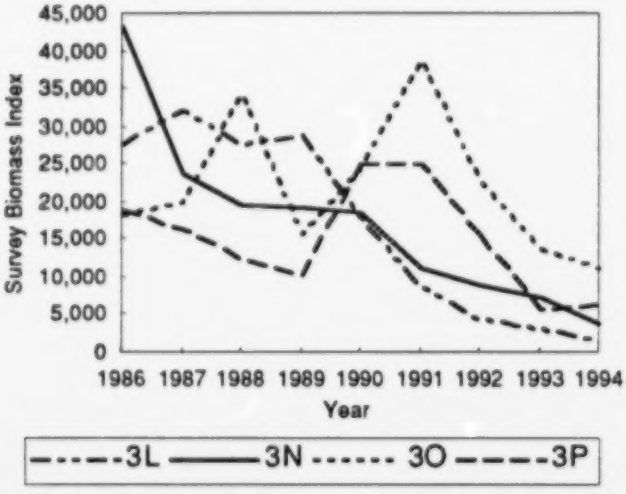
Research Survey Data

As noted above, data on skates have routinely been collected during research surveys to the various areas around Newfoundland. For the purposes of this preliminary examination, data for thorny skate from spring stratified random surveys to divisions 3LNO and Subdivision 3Ps were examined.

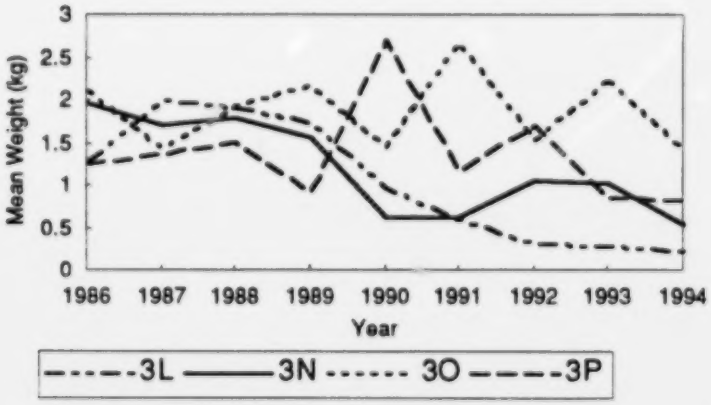
Trawl biomass and abundance indices were calculated for the years 1986 through 1994 for the four areas. From these data, the average weight of thorny skate in each of the areas over time was calculated.

Results

The research vessel indices of biomass and abundance (Table 2) indicate different trends over time in the different areas. Whereas the biomass index, while fluctuating between years, has remained relatively stable in Division 3O and Subdivision 3Ps until the early 1990s, there have been steady declines in the divisions 3LN indices from 1986 to the present. In recent years, the estimates for 3O and 3Ps have also declined and in 1994 were the lowest in the time series.



Coupled with the decline in survey indices of biomass in divisions 3LN, there has been a steady decline in the average size of skate found in the area. No declines in skate size were observed in Division 3O but there has been a recent decline in Subdivision 3Ps.



In 1994, the mean weight of skate in divisions 3LN and 3Ps was only about 0.25 kg., compared to an average of about 0.75 kg. on 3O. These correspond to average wing widths of about 20 and 33 cm (8 and 13 inches) respectively. Detailed examination of the research length frequency

data is necessary before additional information can be provided on the size distribution of thorny skate throughout the area.

DISCUSSION AND PROGNOSIS

Based on the information available in the literature and the results of the preliminary analyses presented above, it appears possible to refine the existing management plan for the future. The current management plan is based on an exploitation rate of 20% of the research survey biomass index. Given that the productivity of skate is so low compared to other fish species (e.g. only 6 to 40 egg cases per year compared to 3 million plus eggs from cod), the 20% level may be too high and a more cautious approach may be to adopt 10 or 15%. This however, requires further examination and study.

The current management plan separates 3LNO from 3Ps. Based on the maturity ogives for females however, it appears more appropriate to separate divisions 3LN from 3O and 3Ps. In addition, there are differences in trends of the research indices in these two areas. Whereas the indices have declined dramatically in divisions 3LN, it remained relatively stable in 3O and declined only recently in 3Ps. Thus it may be appropriate to create 3 management units: 3LN, 3O and 3Ps.

Information from tagging returns suggests that overall thorny skate do not undergo extensive migrations. This would suggest that it is important that fishing effort be spread out over the management units, and not be allowed to concentrate in any one area as local depletions could occur. In other words, it may be necessary to define smaller management or 'allocation' units. Another important consideration is that at a wing width of 46 cm (18 inches), about 50% of females in 3LN are mature, but only about 20% in 3OPs. Fifty percent maturity is not reached until at a wing width of about 56 cm (22 inches) in these areas. Therefore, similar harvesting strategies, if applied to the different areas, could have very different results over the longer term.

Local depletions may have occurred in some inshore areas in 1994, as fishers reported that catch rates could not be sustained in any one area for a long period, and the fleets had to continually move in search of new concentrations. It may also have occurred to some extent during 1995 in the offshore area of Division 3O (Statistical Area 3Oa near the 3Ps boundary). The otter trawl allocation of 1,000 t was taken in approximately 3 weeks. during that period, catch rates steadily declined. When a portion of the 3,000 t reserve was allocated to this fleet, it went back to the 3Oa area but could not locate suitable concentrations of skate.

Results of more detailed analyses of the research survey data including the length frequency information will be useful in helping to devise a sustainable management strategy. Also, examination of the observer database will be helpful, as well clarification of actual skate catches outside 200 miles in divisions 3LN.

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Table 1: Nominal catches of skates in divisions 3LNO and Subdivision 3Ps from the time of extended jurisdiction.

Year	Div. 3L	Div. 3N	Div. 3O	ubdiv. 3Ps	Cdn. TAC
1977	418	962	437	881	
1978	225	1,237	369	710	
1979	393	91	555	666	
1980	396	711	271	1,163	
1981	353	1,224	134	1,078	
1982	112	313	383	512	
1983	170	1,004	107	516	
1984	412	803	798	623	
1985	918	7,591	1,890	965	
1986	3,048	9,451	1,830	1,583	
1987	6,244	10,086	2,166	839	
1988	4,156	14,541	69	783	
1989	3,618	10,493	132	1,685	
1990	9,779	4,796	168	5	
1991	15,587	12,694	125	1	
1992[2]	1,491	3,140	366		
1993[2]					
1994[2]					
1995					6,000[1]

[1] 1995 TAC is split with 5,000 t for 3LNO and 1,000 t for 3Ps

[2] Provisional

Table 2: Biomass and abundance indices from spring research surveys to divisions 3LNO and subdivision 3Ps, 1986-1994.

Biomass Index (t)

Year	Div. 3L	Div. 3N	Div. 3O	Div. 3P
1986	27,506	43,435	18,360	18,871
1987	32,298	23,833	20,081	16,243
1988	27,616	19,561	34,399	12,396
1989	28,855	19,347	15,816	10,142
1990	17,839	18,693	24,388	25,114
1991	8,739	11,388	38,978	25,114
1992	4,623	9,074	22,807	15,843
1993	3,365	7,303	13,824	5,731
1994	1,543	4,013	11,368	6,511

Abundance Index (thousands)

Year	Div. 3L	Div. 3N	Div. 3O	Div. 3P
1986	21,170	22,064	8,733	14,991
1987	16,178	13,859	14,066	11,745
1988	14,475	10,940	17,765	8,193
1989	16,673	12,409	7,305	10,924
1990	18,156	29,610	16,578	9,208
1991	14,372	18,408	14,543	21,370
1992	15,242	8,531	14,697	9,319
1993	11,473	7,053	6,208	6,723
1994	6,611	7,258	7,895	7,943

Table 3: Mean weights of thorny skate estimated from the research survey data.

Mean Weights (kg)

Year	Div. 3L	Div. 3N	Div. 3O	Div. 3P
1986	1.30	1.97	2.10	1.26
1987	2.00	1.72	1.43	1.38
1988	1.91	1.79	1.94	1.51
1989	1.73	1.56	2.17	0.93
1990	0.98	0.63	1.47	2.73
1991	0.61	0.62	2.68	1.18
1992	0.30	1.06	1.55	1.70
1993	0.29	1.04	2.23	0.85
1994	0.23	0.55	1.44	0.82